

WE CLAIM:

1. A method for identifying an immunogenic protein or fragment thereof capable of eliciting an immune response, said method comprising obtaining a protein complex
5 comprising an immunoglobulin or mixtures thereof or an immunoglobulin-containing fraction from a subject or a cell, tissue or organ thereof and identifying a protein or fragment thereof bound to the immunoglobulin by virtue of an antigen antibody interaction, thereby identifying an immunogenic protein or fragment thereof capable of eliciting an immune response.
- 10 2. The method according to claim 1 further comprising obtaining a sample from the subject that comprises the protein complex or mixture thereof or immunoglobulin-containing fraction.
- 15 3. The method according to claim 2 further comprising obtaining one or more immunoglobulin-containing fractions from the sample.
4. The method according to any one of claims 1 to 3 wherein the sample is selected from the group consisting of whole blood, plasma, serum, sputum, saliva, pleural fluid,
20 pericardial fluid, peritoneal fluid, lymph fluid, lymph node, spleen, egg yolk, a fraction of whole blood, a fraction of plasma, a fraction of serum, a fraction of sputum, a fraction of saliva, a fraction of pleural fluid, a fraction of pericardial fluid, a fraction of peritoneal fluid, a fraction of lymph fluid, a fraction of lymph node, a fraction of spleen and a fraction of egg yolk.
- 25 5. The method according to any one of claims 1 to 3 wherein the sample comprises a cell selected from the group consisting of peripheral blood mononuclear cell (PBMC), lymphocyte, B-lymphocyte, T lymphocyte, helper T-cell, cytotoxic T cell, macrophage, dendritic cell, polymorphonuclear cell and mast cell.
- 30 6. The method according to claim 4 wherein the sample comprises serum or an immunoglobulin-containing fraction of serum.
7. The method according to any one of claims 1 to 3 wherein the protein complex
35 or immunoglobulin-containing fraction comprises one or more immunoglobulins

selected from the group consisting of IgM, IgG, IgA, IgE, IgD and IgY or mixtures thereof.

8. The method according to claim 7 wherein the protein complex or immunoglobulin-containing fraction comprises IgG.

9. The method according to claim 7 wherein the protein complex or immunoglobulin-containing fraction thereof comprises IgA.

10. The method according to any one of claims 1 to 3 wherein the protein complex or immunoglobulin-containing fraction is obtained by a process comprising separating or purifying a sample from the subject to thereby provide said protein complex or immunoglobulin-containing fraction.

11. The method according to claim 10 wherein said separating or purifying a sample from the subject comprises contacting the sample with one or more compounds capable of binding an immunoglobulin for a time and under conditions sufficient for binding to occur and isolating the compound.

12. The method according to claim 11 wherein the one or more compounds is/are previously immobilized on a solid support, matrix or resin.

13. The method according to claim 12 wherein the solid support, matrix or resin is selected from the group consisting of cellulose bead, agarose, nylon, magnetic particle, paramagnetic particle, polymeric resin and mixtures thereof.

14. The method according to claim 12 or 13 further comprising washing the one or more immobilized compounds to thereby remove non-specifically bound or unbound protein.

15. The method according to any one of claims 12 to 14 wherein a compound is selected from the group consisting of Protein A or a mimetic thereof, Protein G or a mimetic thereof, Protein L or a mimetic thereof, an anti-immunoglobulin antibody, a maltose binding protein (MBP), a thiophilic resin and mixtures thereof.

16. The method according to claim 15 wherein the compound is Protein A or Protein G or mixtures thereof.
17. The method according to claim 1 or 2 wherein the subject suffers from an infection or has suffered previously from an infection.
18. The method according to claim 17 wherein the infection is an acute infection.
19. The method according to claim 17 wherein the infection is a chronic infection.
20. The method according to any one of claims 17 to 20 wherein the infection is selected from the group consisting of a viral infection, a bacterial infection, a yeast infection, a fungal infection and a parasitic infection.
21. The method according to claim 20 wherein the infection is a bacterial infection.
22. The method according to claim 21 wherein the bacterial infection is a *Pseudomonas* infection.
23. The method according to claim 22 wherein the bacterial infection is a *Mycobacterium* infection.
24. The method according to any one of claims 17 to 23 wherein the infection is a pulmonary infection.
25. The method according to claim 24 wherein the pulmonary infection is caused by or associated with the presence of *Pseudomonas aeruginosa* or *Mycobacterium tuberculosis*.
26. The method according to claim 1 or 2 wherein the subject suffers from an autoimmune condition.
27. The method according to claim 26 wherein the autoimmune condition is associated with an inflammatory condition.

28. The method according to claim 1 or 2 further comprising immunizing a subject with one or more cells or an extract thereof comprising the immunogenic protein or fragment thereof to thereby elicit an immune response to the immunogenic protein or fragment thereof.
- 5 29. The method according to claim 28 wherein the one or more cells or extract thereof is derived from an infectious agent expressing the immunogenic protein or fragment thereof.
- 10 30. The method according to claim 28 or 29 wherein the one or more cells are selected from the group consisting of viral cells, bacterial cells, yeast cells, fungal cells or cells of a parasite or the cellular extract is selected from the group consisting of an extract from a virus, an extract from a bacterium, an extract from a yeast, an extract from a fungus and an extract from a parasite.
- 15 31. The method according to claim 30 wherein the one or more cells are bacterial cells or the cellular extract is a bacterial extract.
32. The method according to claim 31 wherein the bacterial cells are *Pseudomonas* 20 *sp.* or *Mycobacterium sp.*
33. The method according to claim 32 wherein the bacterial cells are *Pseudomonas aeruginosa* or *Mycobacterium tuberculosis*.
- 25 34. The method according to claim 1 or 2 wherein the subject is a non-human animal.
35. The method according to claim 34 wherein the non-human animal is selected from the group consisting of mouse, rat, rabbit, chicken, dog, sheep, ovine, horse and 30 goat.
36. The method according to claim 1 or 2 wherein the subject is a human.
37. The method according to any one of claims 11 to 36 further comprising linking 35 immunoglobulin to the one or more compounds.

38. The method according to claim 37 wherein linking comprises performing a process that comprises contacting a cross-linking agent with the one or more compounds having immunoglobulin bound thereto for a time and under conditions sufficient for covalent linkage to occur between a compound and immunoglobulin.

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39. The method according to claim 38 wherein the cross-linking agent is selected from the group consisting of an imidoester cross-linker, a N-hydroxysuccinimide cross-linker, a maleimide cross-linker, a haloacetyl cross-linker, a pyridyl disulfide cross-linker, a hydrazide cross-linker, and a carbodiimide cross-linker.

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40. The method according to claim 39 wherein the cross linking agent is a N-hydroxysuccinimide cross-linker.

41. The method according to claim 40 wherein the N-hydroxysuccinimide cross-linker is selected from the group consisting of disuccinimidyl glutarate, disuccinimidyl suberate, bis (sulfo-succinimidyl) suberate, dithiobis (succinimidyl propionate), 3, 3' - dithiobis (succinimidyl propionate), ethylene glycobis (succinimidyl succinate), ethylene glycobis (sulfo-succinimidylsuccinate), disuccinimidyl tartarate, disulfosuccinimidyl tartarate, bis[2-(succinimidylloxy-carbonyloxy) ethyl]sulfone, bis[2-(sulfo-succinimidylloxy-carbonyloxy) ethyl]sulfone, succinimidyl 4-(N-maleimidomethyl) cyclohexane-1-carboxylate, sulfo-succinimidyl 4-(N-maleimidomethyl) cyclohexane-1-carboxylate, m-maleimido benzoyl-N-hydroxysuccinimide ester, m-maleimido benzoyl-N-hydroxysulfo succinimide ester, succinimidyl 4-(p-maleimidophenyl)-butyrate, sulfo-succinimidyl 4-(p-maleimidophenyl)-butyrate, bismaleimido-hexane, N-(g-maleimidobutyryloxy)succinimide ester and N-(g-maleimidobutyryloxy)sulfosuccinimide ester.

42. The method according to claim 41 wherein the N-hydroxysuccinimide cross-linker is disuccinimidyl suberate.

43. A method for identifying an immunogenic protein or immunogenic protein fragment of an agent that causes a disease or disorder in a subject comprising:

(i) obtaining a protein complex comprising an immunoglobulin or mixtures thereof or an immunoglobulin-containing fraction from a subject suffering from the

disease or disorder or having suffered previously from the disease or disorder or a cell, tissue or organ thereof;

(ii) contacting immunoglobulin in the protein complex or immunoglobulin-containing fraction with a sample comprising the agent that causes the disease or disorder or a derivative thereof; and

(ii) identifying a protein or fragment thereof bound to said immunoglobulin by virtue of an antigen-antibody interaction,

wherein the identified protein is an immunogenic protein or immunogenic protein fragment of an agent that causes a disease or disorder in a subject.

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44. The method according to claim 43 further comprising obtaining a sample from the subject that comprises the protein complex or immunoglobulin-containing fraction.

45. The method according to claim 44 further comprising obtaining an immunoglobulin-containing fraction from the sample.

46. The method according to any one of claims 43 to 45 wherein the sample is selected from the group consisting of whole blood, plasma, serum, sputum, saliva, pleural fluid, pericardial fluid, peritoneal fluid, lymph fluid, lymph node, spleen, egg yolk, a fraction of whole blood, a fraction of plasma, a fraction of serum, a fraction of sputum, a fraction of saliva, a fraction of pleural fluid, a fraction of pericardial fluid, a fraction of peritoneal fluid, a fraction of lymph fluid, a fraction of lymph node, a fraction of spleen and a fraction of egg yolk.

47. The method according to any one of claims 43 to 45 wherein the sample comprises a cell selected from the group consisting of peripheral blood mononuclear cell (PBMC), lymphocyte, B-lymphocyte, T lymphocyte, helper T-cell, cytotoxic T cell, macrophage, dendritic cell, polymorphonuclear cell and mast cell.

48. The method according to claim 46 wherein the sample comprises serum or an immunoglobulin-containing fraction of serum.

49. The method according to any one of claims 43 to 45 wherein the protein complex or immunoglobulin-containing fraction comprises one or more immunoglobulins selected from the group consisting of IgM, IgG, IgA, IgE, IgD and IgY or mixtures thereof.

50. The method according to claim 49 wherein the protein complex or immunoglobulin-containing fraction comprises IgG.
- 5 51. The method according to claim 49 wherein the protein complex or immunoglobulin-containing fraction comprises IgA.
52. The method according to any one of claims 43 to 45 wherein the protein complex or immunoglobulin-containing fraction is obtained by a process comprising
10 separating or purifying a sample from the subject to thereby provide said protein complex or immunoglobulin-containing fraction.
53. The method according to claim 52 wherein said separating or purifying a sample from the subject comprises contacting the sample with one or more compounds capable
15 of binding an immunoglobulin for a time and under conditions sufficient for binding to occur and isolating the compound.
54. The method according to claim 53 wherein one or more compounds is/are previously immobilized on a solid support, matrix or resin.
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55. The method according to claim 54 wherein the solid support, matrix or resin is selected from the group consisting of cellulose bead, agarose, nylon, polymeric resin and mixtures thereof.
- 25 56. The method according to claim 54 or 55 further comprising washing the one or more immobilized compounds to thereby remove non-specifically bound or unbound protein.
57. The method according to any one of claims 53 to 56 wherein a compound is
30 selected from the group consisting of Protein A or a mimetic thereof, Protein G or a mimetic thereof, Protein L or a mimetic thereof, an anti-immunoglobulin antibody, a maltose binding protein (MBP), a thiophilic resin and mixtures thereof.
58. The method according to claim 57 wherein the compound is Protein A, Protein
35 G or mixtures thereof.

59. The method according to any one of claims 53 to 58 further comprising linking immunoglobulin to the one or more compounds.
60. The method according to claim 59 wherein linking comprises performing a
5 process that comprises contacting a cross-linking agent with the one or more compounds having immunoglobulin bound thereto for a time and under conditions sufficient for covalent linkage to occur between a compound and immunoglobulin.
61. The method according to claim 60 wherein the cross-linking agent is selected
10 from the group consisting of an imidoester cross-linker, a N-hydroxysuccinimide cross-linker, a maleimide cross-linker, a haloacetyl cross-linker, a hydrazide cross-linker, and a carbodiimide cross-linker.
62. The method according to claim 61 wherein the cross linking agent is a N-
15 hydroxysuccinimide cross-linker.
63. The method according to claim 62 wherein the N-hydroxysuccinimide cross-linker is selected from the group consisting of disuccinimidyl glutarate, disuccinimidyl suberate, bis (sulfosuccinimidyl) suberate, dithiobis (succinimidyl propionate), 3, 3' -
20 dithiobis (succinimidyl propionate), ethylene glycobis (succinimidyl succinate), ethylene glycobis (sulfo-succinimidylsuccinate), disuccinimidyl tartarate, disulfosuccinimidyl tartarate, bis[2-(succinimidylloxy-carbonyloxy) ethyl]sulfone, bis[2-(sulfosuccinimidylloxy-carbonyloxy) ethyl]sulfone, succinimidyl 4-(N-maleimidomethyl) cyclohexane-1-carboxylate, sulfo-succinimidyl 4-(N-maleimidomethyl) cyclohexane-1-carboxylate, m-maleimido benzoyl-N-hydroxysuccinimide ester, m-maleimido benzoyl-N-hydroxysulfo succinimide ester, succinimidyl 4-(p-maleimidophenyl)-butyrate, sulfo-succinimidyl 4-(p-maleimidophenyl)-butyrate, bismaleimido hexane, N-(g-maleimidobutyryloxy)succinimide ester and N-(g-maleimidobutyryloxy)
25 sulfosuccinimide ester.
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64. The method according to claim 63 wherein the N-hydroxysuccinimide cross-linker is disuccinimidyl suberate.
65. The method according to claim 43 wherein the sample comprises a protein or
35 cellular extract of the agent that causes the disease or disorder.

66. The method according to claim 43 wherein the agent that causes the disease or disorder is an infectious agent.
- 5 67. The method according to claim 66 wherein the infectious agent is selected from the group consisting of a virus, a bacterium, a yeast, a fungus and a parasite.
68. The method according to claim 67 wherein the infectious agent is a bacterium.
- 10 69. The method according to claim 70 wherein the bacterium is *Pseudomonas aeruginosa* or *Mycobacterium tuberculosis*.
70. The method according to claim 68 or 69 wherein the bacterium is a clinical isolate.
- 15 71. A method for identifying an immunogenic protein or immunogenic protein fragment of a cancer cell comprising:
- (i) obtaining a protein complex comprising an immunoglobulin or mixtures thereof or an immunoglobulin-containing fraction from a subject suffering from cancer
- 20 or having suffered previously from cancer;
- (ii) contacting immunoglobulin in the protein complex or immunoglobulin-containing fraction with a sample comprising the tumor cell or a protein extract or cellular extract thereof; and
- (ii) identifying a protein or fragment thereof bound to said immunoglobulin by
- 25 virtue of an antigen-antibody interaction,
- wherein the identified protein is an immunogenic protein or immunogenic protein fragment of the cancer cell.
72. The method according to claim 70 wherein the cancer cell is selected from the
- 30 group consisting of a bladder cancer cell, a breast cancer cell, a colorectal cancer cell, an endometrial cancer cell, a head and neck cancer cell, a leukemia cell, a lung cancer cell, a lymphoma cell, a melanoma cell, a non-small-cell lung cancer cell, an ovarian cancer cell, a prostate cancer cell, an acute lymphocytic leukemia cell, an adult acute myeloid leukemia cell, an adult non-Hodgkin's lymphoma cell, a brain tumor cell, a
- 35 cervical cancer cell, a childhood sarcoma cell, a chronic lymphocytic leukemia cell, a chronic myeloid leukemia cell, an esophageal cancer cell, a hairy cell leukemia cell, a

kidney cancer cell, a liver cancer cell, a multiple myeloma cell, a neuroblastoma cell, an oral cancer cell, a pancreatic cancer cell, a primary central nervous system lymphoma cell, a skin cancer cell and a small-cell lung cancer cell.

5 73. The method according to claim 72 wherein the cancer cell is an ovarian cancer cell or a breast cancer cell.

74. The method according to claim 71 further comprising obtaining a sample from the subject that comprises the protein complex or immunoglobulin-containing fraction.
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75. The method according to claim 74 further comprising obtaining the protein complex or immunoglobulin-containing fraction from the sample.

76. The method according to any one of claims 71 to 75 wherein the sample is
15 selected from the group consisting of whole blood, plasma, serum, sputum, saliva, pleural fluid, pericardial fluid, peritoneal fluid, lymph fluid, lymph node, spleen, egg yolk, a fraction of whole blood, a fraction of plasma, a fraction of serum, a fraction of sputum, a fraction of saliva, a fraction of pleural fluid, a fraction of pericardial fluid, a fraction of peritoneal fluid, a fraction of lymph fluid, a fraction of lymph node, a
20 fraction of spleen and a fraction of egg yolk.

77. The method according to any one of claims 71 to 75 wherein the sample comprises a cell selected from the group consisting of peripheral blood mononuclear cell (PBMC), lymphocyte, B-lymphocyte, T lymphocyte, helper T-cell, cytotoxic T
25 cell, macrophage, dendritic cell, polymorphonuclear cell and mast cell.

78. The method according to claim 76 wherein the sample comprises serum or an immunoglobulin-containing fraction of serum.

30 79. The method according to any one of claims 71 to 75 wherein the protein complex or immunoglobulin-containing fraction comprises one or more immunoglobulins selected from the group consisting of IgM, IgG, IgA, IgE, IgD and IgY or mixtures thereof.

35 80. The method according to claim 79 wherein the protein complex or immunoglobulin-containing fraction comprises IgG.

81. The method according to claim 79 wherein the protein complex or immunoglobulin-containing fraction comprises IgA.
- 5 82. The method according to any one of claims 71 to 75 wherein the protein complex or immunoglobulin-containing fraction is obtained by a process comprising separating or purifying a sample from the subject to thereby provide said protein complex or immunoglobulin-containing fraction.
- 10 83. The method according to claim 82 wherein said separating or purifying a sample from the subject comprises contacting the sample with one or more compounds capable of binding an immunoglobulin for a time and under conditions sufficient for binding to occur and isolating the compound.
- 15 84. The method according to claim 83 wherein one or more compounds is/are previously immobilized on a solid support, matrix or resin.
85. The method according to claim 84 wherein the solid support, matrix or resin is selected from the group consisting of cellulose bead, agarose, nylon, polymeric resin
20 and mixtures thereof.
86. The method according to claim 84 or 85 further comprising washing the one or more immobilized compounds to thereby remove non-specifically bound or unbound protein.
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87. The method according to any one of claims 83 to 86 wherein a compound is selected from the group consisting of Protein A or a mimetic thereof, Protein G or a mimetic thereof, Protein L or a mimetic thereof, an anti-immunoglobulin antibody, a maltose binding protein (MBP), a thiophilic resin and mixtures thereof.
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88. The method according to claim 87 wherein the compound is Protein A, Protein G or mixtures thereof.
89. The method according to any one of claims 83 to 88 further comprising linking
35 immunoglobulin to the one or more compounds.

90. The method according to claim 89 wherein linking comprises performing a process that comprises contacting a cross-linking agent with the one or more compounds having immunoglobulin bound thereto for a time and under conditions sufficient for covalent linkage to occur between a compound and immunoglobulin.

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91. The method according to claim 90 wherein the cross-linking agent is selected from the group consisting of an imidoester cross-linker, a N-hydroxysuccinimide cross-linker, a maleimide cross-linker, a haloacetyl cross-linker, a hydrazide cross-linker, and a carbodiimide cross-linker.

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92. The method according to claim 91 wherein the cross linking agent is a N-hydroxysuccinimide cross-linker.

93. The method according to claim 92 wherein the N-hydroxysuccinimide cross-linker is selected from the group consisting of disuccinimidyl glutarate, disuccinimidyl suberate, bis (sulfo-succinimidyl) suberate, dithiobis (succinimidyl propionate), 3, 3' - dithiobis (succinimidyl propionate), ethylene glycobis (succinimidyl succinate), ethylene glycobis (sulfo-succinimidylsuccinate), disuccinimidyl tartarate, disulfosuccinimidyl tartarate, bis[2-(succinimidylloxy-carbonyloxy) ethyl]sulfone, bis[2-(sulfo-succinimidylloxy-carbonyloxy) ethyl]sulfone, succinimidyl 4-(N-maleimidomethyl) cyclohexane-1-carboxylate, sulfo-succinimidyl 4-(N-maleimidomethyl) cyclohexane-1-carboxylate, m-maleimido benzoyl-N-hydroxysuccinimide ester, m-maleimido benzoyl-N-hydroxysulfo succinimide ester, succinimidyl 4-(p-maleimidophenyl)-butyrate, sulfo-succinimidyl 4-(p-maleimidophenyl)-butyrate, bismaleimidohexane, N-(g-maleimidobutyryloxy)succinimide ester and N-(g-maleimidobutyryloxy) sulfosuccinimide ester.

94. The method according to claim 93 wherein the N-hydroxysuccinimide cross-linker is disuccinimidyl suberate.

95. A method for identifying an immunogenic protein or fragment thereof capable of eliciting an immune response in an autoimmune condition in a subject, said method comprising:

(i) obtaining a protein complex comprising an immunoglobulin or mixtures thereof or an immunoglobulin-containing fraction from a subject suffering from an autoimmune condition or a cell, tissue or organ thereof;

(ii) contacting immunoglobulin in the protein complex or immunoglobulin-containing fraction with a sample comprising protein from a subject suffering from an autoimmune condition; and

(ii) identifying a protein or fragment thereof bound to said immunoglobulin by virtue of an antigen-antibody interaction,

wherein the identified protein is an immunogenic protein or fragment thereof capable of eliciting an immune response in an autoimmune condition in the subject.

96. The method according to claim 95 further comprising obtaining a sample from the subject that comprises the protein complex or immunoglobulin-containing fraction.

97. The method according to claim 96 further comprising obtaining an immunoglobulin-containing fraction from the sample.

98. The method according to claim 96 or 97 wherein the sample is selected from the group consisting of whole blood, plasma, serum, sputum, saliva, pleural fluid, pericardial fluid, peritoneal fluid, lymph fluid, lymph node, spleen, egg yolk, a fraction of whole blood, a fraction of plasma, a fraction of serum, a fraction of sputum, a fraction of saliva, a fraction of pleural fluid, a fraction of pericardial fluid, a fraction of peritoneal fluid, a fraction of lymph fluid, a fraction of lymph node, a fraction of spleen and a fraction of egg yolk.

99. The method according to any one of claims 95 to 98 wherein the sample comprises a cell selected from the group consisting of peripheral blood mononuclear cell (PBMC), lymphocyte, B-lymphocyte, T lymphocyte, helper T-cell, cytotoxic T cell, macrophage, dendritic cell, polymorphonuclear cell and mast cell.

100. The method according to claim 98 wherein the sample comprises serum or an immunoglobulin-containing fraction of serum.

101. The method according to any one of claims 95 to 97 wherein the protein complex or immunoglobulin-containing fraction comprises one or more

immunoglobulins selected from the group consisting of IgM, IgG, IgA, IgE, IgD and IgY or mixtures thereof.

102. The method according to claim 101 wherein the protein complex or
5 immunoglobulin-containing fraction thereof comprises IgG.

103. The method according to claim 101 wherein the protein complex or immunoglobulin-containing fraction thereof comprises IgA.

104. The method according to any one of claims 95 to 97 wherein the protein complex or immunoglobulin-containing fraction is obtained by a process comprising separating or purifying a sample from the subject to thereby provide said protein complex thereof or immunoglobulin-containing fraction.

105. The method according to claim 104 wherein said separating or purifying a sample from the subject comprises contacting the sample with one or more compounds capable of binding an immunoglobulin for a time and under conditions sufficient for binding to occur and isolating the compound.

106. The method according to claim 105 wherein one or more compounds is/are previously immobilized on a solid support, matrix or resin.

107. The method according to claim 106 wherein the solid support, matrix or resin is selected from the group consisting of cellulose bead, agarose, nylon, a magnetic
25 particle, a paramagnetic particle, polymeric resin and mixtures thereof.

108. The method according to claim 106 or 107 further comprising washing the one or more immobilized compounds to thereby remove non-specifically bound or unbound protein.

109. The method according to any one of claims 106 to 108 wherein the compound is selected from the group consisting of Protein A or a mimetic thereof, Protein G or a mimetic thereof, Protein L or a mimetic thereof, an anti-immunoglobulin antibody, a maltose binding protein (MBP), a thiophilic resin and mixtures thereof.

110. The method according to claim 109 wherein a compound is Protein A, Protein G or mixtures thereof.
111. The method according to any one of claims 105 to 110 further comprising
5 linking immunoglobulin to the one or more compounds.
112. The method according to claim 90 wherein linking comprises performing a process that comprises contacting a cross-linking agent with the one or more compounds having immunoglobulin bound thereto for a time and under conditions
10 sufficient for covalent linkage to occur between a compound and immunoglobulin.
113. The method according to claim 112 wherein the cross-linking agent is selected from the group consisting of an imidoester cross-linker, a N-hydroxysuccinimide cross-linker, a maleimide cross-linker, a haloacetyl cross-linker, a hydrazide cross-linker, and
15 a carbodiimide cross-linker.
114. The method according to claim 113 wherein the cross linking agent is a N-hydroxysuccinimide cross-linker.
- 20 115. The method according to claim 114 wherein the N-hydroxysuccinimide cross-linker is selected from the group consisting of disuccinimidyl glutarate, disuccinimidyl suberate, bis (sulfo-succinimidyl) suberate, dithiobis (succinimidyl propionate), 3, 3' - dithiobis (succinimidyl propionate), ethylene glycobis (succinimidyl succinate), ethylene glycobis (sulfo-succinimidylsuccinate), disuccinimidyl tartarate,
25 disulfosuccinimidyl tartarate, bis[2-(succinimidylloxy-carbonyloxy) ethyl]sulfone, bis[2-(sulfo-succinimidylloxy-carbonyloxy) ethyl]sulfone, succinimidyl 4-(N-maleimidomethyl) cyclohexane-1-carboxylate, sulfo-succinimidyl 4-(N-maleimidomethyl) cyclohexane-1-carboxylate, m-maleimido benzoyl-N-hydroxysuccinimide ester, m-maleimido benzoyl-N-hydroxysulfo succinimide ester,
30 succinimidyl 4-(p-maleimidophenyl)-butyrate, sulfo-succinimidyl 4-(p-maleimidophenyl)-butyrate, bismaleimidohexane, N-(g-maleimidobutyryloxy)succinimide ester and N-(g-maleimidobutyryloxy) sulfosuccinimide ester.
- 35 116. The method according to claim 115 wherein the N-hydroxysuccinimide cross-linker is disuccinimidyl suberate.

117. The method according to claim 95 or 96 wherein the subject is a human and suffers from an autoimmune condition.
- 5 118. The method according to claim 117 wherein the autoimmune condition is an autoimmune disease.
119. The method according to claim 118 wherein the autoimmune disease is selected from the group consisting of rheumatoid arthritis, multiple sclerosis, type-1 diabetes,
10 inflammatory bowel disease, Crohn's Disease, ulcerative colitis, systemic lupus erythematosus, psoriasis, scleroderma, autoimmune thyroid disease, central nervous system vasculitis, and autoimmune myositis
120. The method according to claim 117 wherein the subject suffers from cystic
15 fibrosis.
121. The method according to claim 120 wherein the subject has previously suffered from an acute pulmonary exacerbation.
- 20 122. The method according to claim 120 wherein the subject is suffering from an acute pulmonary exacerbation.
123. The method according to any one of claims 120 to 122 wherein the subject additionally suffers from an infection.
- 25 124. The method according to claim 123 wherein the infection is caused by a bacterium.
125. The method according to claim 104 wherein the bacterium is selected from the
30 group consisting of *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Haemophilus influenzae*, *Aspergillus fumigatus*, *Burkholderia cepacia* complex, *Stenotrophomonas maltophilia*, *Alcaligenes (Achromobacter) xylosoxidans*, *B. gladioli* and *Ralstonia picketti* or mixtures thereof
- 35 126. The method according to claim 125 wherein the bacterium comprises a *Pseudomonas aeruginosa* infection.

127. The method according to claim 95 or 96 wherein the sample is derived from the subject from which the protein complex comprising an immunoglobulin or mixtures thereof or an immunoglobulin-containing fraction was derived.

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128. A method for identifying an immunogenic protein or fragment thereof capable of eliciting an immune response in a subject, said method comprising:

(i) obtaining a protein complex comprising an immunoglobulin or mixtures thereof or an immunoglobulin-containing fraction from a sample from or produced by a subject previously administered with a sample comprising a cell or cell extract or mixture thereof comprising the immunogenic protein or fragment thereof;

(ii) contacting the protein complex or immunoglobulin-containing fraction with a sample comprising the cell or a cell extract thereof or mixture thereof; and

(iii) identifying a protein or fragment thereof bound to immunoglobulin in the protein complex or immunoglobulin-containing fraction by virtue of an antigen antibody interaction,

thereby identifying an immunogenic protein or fragment thereof capable of eliciting an immune response in a subject.

129. The method according to claim 128 further comprising administering sample comprising the cell or cell extract to the subject.

130. The method according to claim 129 wherein the cell or cell extract is from an agent that causes a disease or disorder.

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131. The method according to claim 130 wherein the agent that causes a disease or disorder is an infectious agent.

132. The method according to claim 131 wherein the infectious agent is selected from the group consisting of a virus, a bacterium, a yeast, a fungus and a parasite.

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133. The method according to claim 132 wherein the infectious agent is a bacterium

134. The method according to claim 133 wherein the bacterium is *Mycobacterium tuberculosis*.

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135. The method according to claim 128 or 129 further comprising obtaining a sample from or produced by the subject.
136. The method according to claim 135 wherein the subject is a non-human animal.
- 5 137. The method according to claim 136 wherein the non-human animal is selected from the group consisting of a mouse, a rat, a rabbit, a chicken, a dog, a sheep, an ovine, a horse, a donkey and a goat.
- 10 138. The method according to any one of claims 135 to 137 wherein the subject is avian and the biological sample produced by the subject is an egg or an extract thereof or a derivative thereof.
139. The method according to claim 138 wherein the subject is a chicken.
- 15 140. The method according to claim 128 further comprising obtaining an immunoglobulin-containing fraction from the sample.
141. The method according to claim 140 wherein the sample is selected from the
- 20 group consisting of whole blood, plasma, serum, sputum, saliva, pleural fluid, pericardial fluid, peritoneal fluid, lymph fluid, lymph node, spleen, egg yolk, a fraction of whole blood, a fraction of plasma, a fraction of serum, a fraction of sputum, a fraction of saliva, a fraction of pleural fluid, a fraction of pericardial fluid, a fraction of peritoneal fluid, a fraction of lymph fluid, a fraction of lymph node, a fraction of spleen
- 25 and a fraction of egg yolk.
142. The method according to claim 140 or 141 wherein the sample comprises a cell selected from the group consisting of peripheral blood mononuclear cell (PBMC), lymphocyte, B-lymphocyte, T lymphocyte, helper T-cell, cytotoxic T cell, macrophage,
- 30 dendritic cell, polymorphonuclear cell and mast cell.
143. The method according to claim 141 wherein the sample comprises serum or an immunoglobulin-containing fraction of serum or egg yolk or an immunoglobulin-containing fraction of egg yolk.

144. The method according to claim 95 wherein the protein complex or immunoglobulin-containing fraction comprises one or more immunoglobulins selected from the group consisting of IgM, IgG, IgA, IgE, IgD and IgY or mixtures thereof.
- 5 145. The method according to claim 144 wherein the protein complex or immunoglobulin-containing fraction thereof comprises IgG.
146. The method according to claim 144 wherein the protein complex or immunoglobulin-containing fraction thereof comprises IgA.
- 10 147. The method according to claim 144 wherein the protein complex or immunoglobulin-containing fraction thereof comprises IgY.
148. The method according to claim 128 wherein the protein complex or
15 immunoglobulin-containing fraction is obtained by a process comprising separating or purifying a sample from the subject to thereby provide said protein complex or immunoglobulin-containing fraction thereof.
149. The method according to claim 148 wherein said separating or purifying
20 comprises contacting the sample with one or more compounds capable of binding an immunoglobulin for a time and under conditions sufficient for binding to occur and isolating the compound.
150. The method according to claim 149 wherein one or more compounds is/are
25 previously immobilized on a solid support, matrix or resin.
151. The method according to claim 131 wherein the solid support, matrix or resin is selected from the group consisting of cellulose bead, agarose, nylon, a magnetic particle, a paramagnetic particle and polymeric resin.
- 30 152. The method according to claim 150 or 151 further comprising washing the one or more immobilized compounds to thereby remove non-specifically bound or unbound protein.
- 35 153. The method according to any one of claims 149 to 152 wherein the one or more compounds is selected from the group consisting of Protein A or a mimetic thereof,

Protein G or a mimetic thereof, Protein L or a mimetic thereof, an anti-immunoglobulin antibody, a maltose binding protein (MBP), a thiophilic resin and mixtures thereof.

154. The method according to claim 153 wherein a compound is Protein A, Protein G
5 or mixtures thereof.

155. The method according to any one of claims 149 to 154 further comprising linking immunoglobulin to the one or more compounds.

10 156. The method according to claim 155 wherein linking comprises performing a process that comprises contacting a cross-linking agent with the one or more compounds having immunoglobulin bound thereto for a time and under conditions sufficient for covalent linkage to occur between a compound and immunoglobulin.

15 157. The method according to claim 156 wherein the cross-linking agent is selected from the group consisting of an imidoester cross-linker, a N-hydroxysuccinimide cross-linker, a maleimide cross-linker, a haloacetyl cross-linker, a hydrazide cross-linker, and a carbodiimide cross-linker.

20 158. The method according to claim 157 wherein the cross linking agent is a N-hydroxysuccinimide cross-linker.

159. The method according to claim 158 wherein the N-hydroxysuccinimide cross-linker is selected from the group consisting of disuccinimidyl glutarate, disuccinimidyl
25 suberate, bis (sulfosuccinimidyl) suberate, dithiobis (succinimidyl propionate), 3, 3' - dithiobis (succinimidyl propionate), ethylene glycobis (succinimidyl succinate), ethylene glycobis (sulfo-succinimidylsuccinate), disuccinimidyl tartarate, disulfosuccinimidyl tartarate, bis[2-(succinimidylloxy-carbonyloxy) ethyl]sulfone, bis[2-(sulfosuccinimidylloxy-carbonyloxy) ethyl]sulfone, succinimidyl 4-(N-
30 maleimidomethyl) cyclohexane-1-carboxylate, sulfo-succinimidyl 4-(N-maleimidomethyl) cyclohexane-1-carboxylate, m-maleimido benzoyl-N-hydroxysuccinimide ester, m-maleimido benzoyl-N-hydroxysulfo succinimide ester, succinimidyl 4-(p-maleimidophenyl)-butyrate, sulfo-succinimidyl 4-(p-maleimidophenyl)-butyrate, bismaleimidohexane, N-(g-
35 maleimidobutyryloxy)succinimide ester and N-(g-maleimidobutyryloxy) sulfosuccinimide ester.

160. The method according to claim 159 wherein the N-hydroxysuccinimide cross-linker is disuccinimidyl suberate.
- 5 161. The method according to claim 128, wherein the sample comprising the cell or cell extract or mixture thereof that is contacted to the protein complex comprising an immunoglobulin or mixtures thereof or an immunoglobulin-containing fraction thereof is derived from a subject comprising the cell or cell extract.
- 10 162. The method according to claim 161 wherein the cell or cell extract is derived from an agent that causes a disease or disorder and the sample comprising the cell or cell extract or mixture thereof is derived from a subject suffering from the disease or disorder.
- 15 163. The method according to claim 162 wherein the agent that causes a disease or disorder is an infectious agent.
164. The method according to claim 163 wherein the infectious agent is selected from the group consisting of a virus, a bacterium, a yeast, a fungus and a parasite.
- 20 165. The method according to claim 164 wherein the infectious agent is a bacterium
166. The method according to claim 165 wherein the bacterium is *Mycobacterium tuberculosis*.
- 25 167. The method according to any one of claims 1 to 166 additionally comprising separating an immunogenic protein or fragment thereof bound to the immunoglobulin by virtue of an antigen antibody interaction from the immunoglobulin.
- 30 168. The method according to claim 167 wherein the immunogenic protein or fragment thereof is separated from the immunoglobulin by a method that comprises contacting the protein complex or immunoglobulin-containing fraction with a compound that disrupts the antigen-antibody interaction for a time and under conditions sufficient to disrupt the antigen-antibody interaction.

169. The method according to claim 168 wherein the compound that disrupts the antigen-antibody interaction is selected from the group consisting a compound that modulates the pH of the immunoglobulin fraction, a salt, an ionic detergent , a dissociating agent and a chaotropic agent.

5

170. The method according to any one of claims 1 to 169 additionally comprising isolating a protein that is or was bound to the immunoglobulin-containing fraction by virtue of an antigen-antibody interaction.

10 171. The method according to claim 170 wherein the protein is isolated using gel electrophoresis.

172. The method according to claim 171 wherein the gel electrophoresis is two-dimensional gel electrophoresis.

15

173. The method according to any one of claims 1, 43, 95 or 128 wherein a protein that is or was bound to the immunoglobulin-containing fraction by virtue of an antigen-antibody interaction is identified using mass spectrometry.

20 174. The method according to claim 172 wherein said mass spectrometry is matrix-assisted laser desorption/ionisation-time-of-flight mass spectrometry (MALDI-TOF MS).

175. A method comprising:

25 (a) obtaining a protein complex comprising an immunoglobulin or mixtures thereof or an immunoglobulin-containing fraction from a subject that has raised an immune response against an immunogenic protein or fragment thereof or a cell, tissue or organ thereof by a method comprising contacting a sample from the subject with one or more compounds capable of binding an immunoglobulin for a time and under
30 conditions sufficient for binding to occur and isolating the one or more compounds;

(b) linking immunoglobulin in the protein complex or immunoglobulin-containing fraction to the one or more compounds;

(c) separating an immunogenic protein or fragment thereof from the linked immunoglobulin;

35 (d) contacting a sample comprising the immunogenic protein or fragment thereof with the linked immunoglobulin;

(e) separating the immunogenic protein or fragment thereof from the linked immunoglobulin;

(f) optionally, repeating (d) and (e) one or more times; and

(g) identifying a protein or fragment thereof separated from the
5 immunoglobulin,

thereby identifying an immunogenic protein or fragment thereof.

176. The method according to claim 175 wherein (e) separating the immunogenic protein or fragment thereof from the linked immunoglobulin is performed prior to (d)
10 contacting a sample comprising the immunogenic protein or fragment thereof with the linked immunoglobulin.

177. The method according to claim 175 wherein (d) contacting a sample comprising the immunogenic protein or fragment thereof with the linked immunoglobulin is
15 performed prior to (e) separating the immunogenic protein or fragment thereof from the linked immunoglobulin.

178. The method according to any one of claims 175 to 177 wherein (d) contacting a sample comprising the immunogenic protein or fragment thereof with the linked
20 immunoglobulin and (e) separating the immunogenic protein or fragment thereof from the linked immunoglobulin are repeated a sufficient number of times to identify one or more immunogenic proteins.

179. The method according to claim 175 wherein the subject has raised an immune
25 response against an agent that causes a disease or disorder.

180. The method according to claim 177 wherein the sample comprising the immunogenic protein or fragment thereof that is contacted with the linked
immunoglobulin comprises the agent that causes the disease or disorder or a derivative
30 thereof.

181. The method according to claim 179 or 180 wherein the agent that causes the disease or disorder is an infectious agent.

35 182. The method according to claim 181 wherein the infectious agent is a bacterium.

183. The method according to claim 182 wherein the bacterium is *Mycobacterium tuberculosis*.

5 184. The method according to claim 175 wherein the subject suffers from an autoimmune condition.

185. The method according to claim 184 wherein the sample comprising the immunogenic protein or fragment thereof that is contacted with the linked
10 immunoglobulin comprises protein from a subject suffering from an autoimmune condition.

186. The method according to claim 175 wherein the subject has been previously immunized with a sample comprising a cell or extract thereof or mixtures thereof
15 comprising the immunogenic protein or fragment thereof.

187. The method according to claim 186 wherein the sample comprising the immunogenic protein or fragment thereof that is contacted with the linked immunoglobulin comprises the cell or extract thereof.
20

188. The method according to claim 186 or 187 wherein the subject is a chicken.

189. The method according to any one of claims 186 to 188 wherein the subject has been previously immunized with a cell or cell extract from an agent associated with a
25 disease or disorder.

190. The method according to claim 189 wherein the agent associated with a disease or disorder is an infectious agent.

30 191. The method according to claim 190 wherein the infectious agent is a bacterium.

192. The method according to claim 191 wherein the bacterium is *Mycobacterium tuberculosis*.

193. Use of the method according to any one of claims 1 to 192 in a process for identifying a marker of a condition.
194. Use of the method according to any one of claims 1 to 192 in the diagnosis of a
5 condition.
195. The use according to claim 193 or 194 wherein the condition is a disease or disorder.
- 10 196. The use according to claim 195 wherein the disease or disorder is an infectious disease.
197. The use according to claim 195 wherein the disease or disorder is a cancer.
- 15 198. The use according to claim 194 or 195 wherein the condition is an autoimmune condition.